

CLAIMS

I claim:

1 1. A high bandwidth efficient method for spread spectrum
2 modulation using a chirp waveform, comprising the steps of:

3 (a) encoding an information data signal, the encoded
4 signal having a plurality of symbols encoded at a symbol rate,
5 each symbol having a symbol duration;

6 (b) splitting the information data signal into a
7 plurality of parallel information data signals using a serial
8 to parallel converter;

9 (c) generating a plurality of orthogonal chirp waveforms
10 which are orthogonal in frequency;

11 (d) modulating said plurality of parallel information
12 data signals with said plurality of orthogonal chirp waveforms
13 in order to produce a plurality of parallel information data
14 signals modulated on orthogonal chirp waveforms;

15 (e) combining said plurality of plurality of parallel
16 information data signals modulated on orthogonal chirp
17 waveforms to produce a combined waveform; and

18 (f) transmitting said combined waveform.

1 2. The high bandwidth efficient method according to claim 1,
2 wherein step (d) further comprises modulating said plurality of
3 parallel information data signals with said plurality of orthogonal
chirp waveforms using binary phase shift keying.

1 3. The high bandwidth efficient method according to claim 1,
2 wherein step (d) further comprises modulating said plurality of
3 parallel information data signals with said plurality of orthogonal
4 chirp waveforms using quadrature phase shift keying.

1 4. The high bandwidth efficient method according to claim 1,
2 wherein step (d) further comprises modulating said plurality of
3 parallel information data signals with said plurality of orthogonal
4 chirp waveforms using quadrature amplitude modulation.

1 5. The high bandwidth efficient method according to claim 4,
2 wherein one of said plurality of orthogonal waveforms is modulated
3 with frequency, time, and phase estimation data for
4 synchronization.

1 6. The high bandwidth efficient method according to claim 1,
2 further comprising the step of modulating said combined waveform
3 with a radio frequency carrier before step (f).

1 7. The high bandwidth efficient method according to claim 1,
2 further comprising the step of amplifying said combined waveform
3 for transmission over wireline before step (f).

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1 8. The high bandwidth efficient method according to claim 1,
2 further comprising the step of increasing symbol duration while
3 keeping bandwidth constant, whereby system gain is increased while
4 information rate is constant.

1 9. The high bandwidth efficient method according to claim 1,
2 further comprising the step of reducing the symbol rate while
3 keeping bandwidth constant, whereby system gain is increased while
4 information rate is constant.

1 10. The high bandwidth efficient method according to claim 1,
2 wherein step (c) further comprises generating a plurality of
3 orthogonal waveforms which is fewer in number than the product of
4 the bandwidth times the symbol duration, whereby power spectrum
5 density is decreased without deterioration in bit error rate.

1 11. The high bandwidth efficient method according to claim 1,
2 wherein step (c) further comprises generating a plurality of
3 orthogonal waveforms equal in number to the spread spectrum
4 processing gain, or the time-bandwidth product BT .

1 12. The high bandwidth efficient method according to claim 1,
2 wherein each said orthogonal chirp waveform comprises a sequence of
3 discrete values defining a chirp waveform, said plurality of
4 sequences being orthogonal to each other.

13. A high bandwidth efficient spread spectrum modulation system using a chirp waveform, comprising:

(a) at least one transmitter having:

(i) an encoder for encoding an information data signal;

(ii) an interleaver connected to said encoder for interleaving the information data signal;

(iii) a serial to parallel convertor connected to said interleaver for converting said information data signal into a plurality of parallel information data signals;

(iv) a plurality of stored orthogonal sequences, each sequence defining a chirp waveform;

(v) modulation means for modulating said plurality of orthogonal sequences with said plurality of parallel information data signals;

(vi) a combiner connected to said modulation means for combining said modulated parallel information data signals in order to define a combined signal; and

(vii) means for transmitting said combined signal; and

(b) at least one receiver having:

(i) means for receiving said combined signal;

(ii) at least one storage device having said plurality of orthogonal sequences stored therein;

26 (iii) demodulation means for demodulating said
27 combined signal using the plurality of orthogonal
28 sequences stored in said storage device

29 (iv) a parallel to serial converter connected to
30 said demodulation means;

31 (v) a deinterleaver connected to said parallel to
32 serial converter for deinterleaving the demodulated
33 serial signal; and

34 (vi) a decoder connected to said de-interleaver for
35 decoding the received signal in order to reproduce the
36 information data signal.

1 14. The high bandwidth efficient spread spectrum modulation
2 system according to claim 13, wherein:

3 (a) said modulation means comprises a plurality of
4 quadrature phase modulation circuits; and

5 (b) said demodulation means comprises a plurality of
6 correlators.